



DBX-1603010602020600 Seat No. _____

M. Sc. (Sem. II) (CBCS) (W.E.F. 2016) Examination

July - 2022

Physics : CT-06

(Atomic & Molecular Physics)

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :** (1) All questions carry equal marks.
(2) Full marks are indicated at the right end of each question.
(3) Symbols have their usual meanings.

1 Answer any **seven** of the following : **14**

- (a) Give the term symbol of the system having $S=1/2$ and $L = 2$.
- (b) What do you mean by multiplicity of an energy level ?
- (c) What is j-j coupling ?
- (d) What is interval rule ?
- (e) What are rigid and non-rigid rotators ?
- (f) What is meant by isotopic substitution in a molecule ? Explain with a suitable example.
- (g) Whom do you call the IR-region of electromagnetic spectrum ? Explain each subdivision of IR-region with reference to its usefulness.
- (h) What is Klystron ?
- (i) What is the role of "Source" in an IR Spectrophotometer?
- (j) What are hot bands ?

2 Answer any Two of the following : **14**

- (a) State and discuss : Building up rules.
- (b) Discuss the contribution of more electrons in the outer shell to the total angular momentum of the atom.
- (c) What is Stark Effect ? Discuss its experimental arrangement with diagram.

3 Answer Both of the following : **14**

(a) Discuss Paschen Back Effect in the principle of series of Lithium.

(b) Discuss the explanation of normal Zeeman Effect on the basis of quantum mechanical theory.

OR

3 Answer Both of the following : **14**

(a) How the molecules are classified based on the relative values of principle moments of inertia ? Give at least two-two examples of each case.

(b) Explain the rotational spectra of rigid diatomic molecules depicting the rotational energy levels and transitions.

4 Answer any Two of the following : **14**

(a) Discuss Symmetric Top Molecules in detail showing the schematic representation of energy levels and transitions for the rigid prolate and rigid oblate symmetric rotors.

(b) What is Stark Effect ? Discuss the first order Stark Effect of a Symmetric Top Molecule for the $J = 1, K = 1 \rightarrow J = 2, K = 1$ transition.

(c) Discuss the Morse curve and the energy levels of a diatomic molecule.

5 Write short notes on any Two of the following : **14**

(a) Diatomic Vibrating Rotator.

(b) IR Spectrophotometer.

(c) Normal Vibrations of Carbon Dioxide and Water molecules.

(d) Fine structure in the spectrum of hydrogen atom.
